ROYAL GARDENS, KEW.

BULLETIN

OF

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CCCCXCIV.—ROOT DISEASES CAUSED BY FUNGI.

Amongst the numerous root diseases of various plants caused by parasitic fungi, none are better known, or extending over a greater area than the Pourridié of the French, which occurs in France, Italy, Switzerland, Austria, South-West Germany, and has recently been recorded from three widely separated localities in Britain. The fungus causing this disease is called *Dematophora necatrix*, Hartig, which frequently devastates vineyards and orchards; its attacks, however, are unfortunately not confined to vines and fruit trees; potatoes, beans, beet, &c., are also destroyed, and Hartig states that the mycelium soon kills young maples, oaks, beeches, pines, and spruces.

The mycelium first attacks and kills the youngest rootlets, and then enters into the larger branches of the root, in which it rapidly spreads and forms an irregular network of slender strands; finally bursting through the cortex and enveloping the roots in a snow-white, fluffy mycelium, here and there, running into slender cord-like strands, which traverse the soil, and by this means spreads from one tree to another. At a later stage of development, numerous minute, black compact masses of mycelium or sclerotia are formed in the cortex of the roots, and from each of these spring several slender spines, each of which bears an abundant crop of conidia or reproductive bodies at its tip. In addition to the white mycelium, a very characteristic pale brown or olive mycelium is also present on the surface of the roots, formed of septate or jointed threads of variable thickness, having pear-shaped swellings at intervals; these swollen portions finally become free by the disappearance of the intermediate portions of the mycelium, and form bodies capable of germinating and giving origin to a new crop of mycelium. Under certain conditions some of the sclerotia, instead of producing the spine-like bodies bearing conidia, become converted into hollow spheres or pycnidia, containing in their interior numerous minute reproductive bodies or stylospores which germinate at once and produce new plants. Finally, the highest, or ascigerous form of fruit is rare, and only develops on old trunks that have been dead and decayed for a long time. Up to the present the last-mentioned form of fruit has only been met with in France, and its structure is such that the fungus proves to belong to the *Tuberacei* or truffle family.

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Dematophora necatrix is almost entirely confined to heavy clay soils, where the water drains away with difficulty, whereas *Dematophora glomerata*, Viala, an allied, but much rarer fungus, with a similar destructive habit, hitherto observed only in France, is met with attacking plants growing in loose sandy soil, where the subsoil is wet.

During the spring of the present year, a sample of soil was received by the Royal Horticultural Society from Mr. Hooper, Cambridge, Waikato, New Zealand, containing roots of apple trees attacked by a fungus, with a communication stating that the roots of fruit trees which penetrated the places where the fungus appeared to reside became infected, the fungus penetrating the tree and ultimately killing it. This material was forwarded to Kew for investigation. Sterile mycelium alone was present, which appeared to agree in every detail with that of *Dematophora necatrix*, and the fungus was provisionally referred to that species in a brief report published in the Journal of the Royal Horticultural Society (xix., part I., 28). The following account will give an idea of the injury caused by this fungus, as observed by Mr. R. Allan Wight, of Aukland, New Zealand* :—

"This fungus, in the mycelial stage, attacks a great variety of tree roots, amongst the most conspicuous of which are the apple, pear, peach, and all other common orchard trees. The whitethorn is also very subject to its attacks, as well as a great many *Abies*, and several of the native trees and plants. It also attacks the cabbage, the potato, docks, sorrel, fern, and in fact is almost omnivorous, which is a marked peculiarity. The only plants I have ever known to resist it are the resinous pines and roses; the former suffer at first, and the leaves turn yellow, but they ultimately recover, and I never knew one to succumb, whereas the contrary is the case with all other plants attacked."

"In hedges of whitethorn, where roses have been planted at intervals, the thorns are killed and the roses remain intact and quite uninjured. In an orchard it will appear in patches, killing the fern and sorrel, and spreading until it reaches a fruit tree; it then attacks the bark round the stem just under the ground, which speedily rots, presenting the appearance of having been cooked, and has an offensive smell; it then proceeds along the roots, and the tree soon shows withered leaves, which drop off, leaving it bare; and by and by it falls over and lies on the ground. Its movements are uncertain; sometimes a tree here and there dies; sometimes a whole row, and very often acres are swept off. Many entire orchards of fine trees are killed in a few years. This fungus is never found in clay or other damp soils, but always in very friable lands Professor Kirk, of Wellington, says it is *Lycoperdon gemmatum*, Batsch., and that "tar water" is a certain cure. The last statement is assuredly an error, and I think the first is also. For a great many years I have endeavoured in vain to procure the fruit of this fungus, using all the means that suggested themselves to me, without any success. I have seen large quantities of the *L. gemmatum* growing in orchards where there is no root fungus, and I have seen a very great many orchards, and watched several closely where hundreds of trees are attacked, and could never find the mycelium connected with the *Lycoperdon*."

"The pest is most plentiful on the skirts of the primeval forests and on fern lands adjoining where no cultivation has ever been resorted to. Whole crops of potatoes are destroyed on such lands, and on dry lands where native tree stumps remain it is very prevalent. My own opinion is that it is a fungus native to, and probably peculiar to, New Zealand

* Journ. Mycol. Vol. v., p. 199.

(in the North Island only). All my experiments with sulphur and lime have failed. Kerosine oil used in winter has alone been of any use, and that has been used pure in winter without killing the trees. The fungi of New Zealand are legion, and very destructive, but this is the worst, and particularly as it is confined to dry soils. Where I am now writing 500 trees have been killed within the last two years, and all remedies tried have failed. The apple scab, the shot-hole fungus, the oidium of the vine are terrible pests in New Zealand, and the settlers have more to fear from fungus growths than insect pests."

As previously stated, the material received from New Zealand was, in the first instance, referred to *Dematophora necatrix*. Further development of the fungus, and the receipt of additional fruiting specimens from the same country, showed that this was a mistake, neither does the fungus belong to any known species. It will, therefore, be described as new, under the name *Rosellinia radiciperda*. On arrival, the diseased roots and infected soil were permeated throughout with delicate white strands of mycelium. The roots were laid on the surface of a thin layer of sterilized leaf-mould kept moist and protected by a bell-jar. Two boxes, each about one foot square and six inches deep, were filled to within an inch of the top with sterilized leaf-mould. A thin layer of the infected soil was sprinkled on the surface of the soil in each box; in addition, a portion of the root of an "Orange Pippin" apple tree was thrust into the soil of one box, and two beech seedlings planted in the other. Finally the boxes were covered with glass to prevent contamination from floating spores of fungi, kept damp, and placed at the foot of a wall having an eastern aspect, where they remained from June till the end of August. At the end of a month, the roots under the bell-jar, were densely covered with a snow-white fluffy mycelium, giving off numerous delicate white strands which spread into the leaf-mould. By degrees the mycelium on the roots gradually changed to a pale brown colour, and under the microscope the strands of mycelium showed pear-shaped swellings at intervals—hitherto considered as characteristic of *Dematophora necatrix*—represented on the plate, fig. 7. Viala states that in *D. necatrix* these swollen portions gradually become globose and free, if the mycelium is kept very wet, and form reproductive bodies—chlamydospores—capable of germinating and producing new mycelium. I was not successful in producing this result with the mycelium of the New Zealand fungus, although presumably, from analogy, this failure may be due to a lack of some essential factor. At a still later stage, numerous minute sclerotia burst through the cortex of the roots, which in course of time bore clusters of erect stems, each composed of a fascicle of parallel hyphæ, which bear conidia at their much-branched tips, as represented in figs. 8, 9, 10. Scattered at intervals amongst the sclerotia were minute black bodies, which proved to be a second form of fruit, known as pycnidia, and containing minute spore-like bodies—stylospores—in their interior, (figs. 11, 12). The stylospores germinated and produced a delicate mycelium within twenty-four hours when sown in pure water. The same is true of the conidia previously mentioned. The highest or ascigerous condition of fruit was not produced on the roots, owing probably to their disintegrated condition, a more durable matrix being essential for its development. During the period of this investigation, a parcel of New Zealand fungi, collected and communicated by W. Colenso, M.A., F.R.S., was received at Kew, and amongst the number was a species of *Rosellinia*, marked "at the base of a fallen and decayed apple tree." Careful examination of this specimen revealed

the presence of sclerotia bearing conidia identical with those of the fungus under consideration, mixed with the perithecia or ascigerous condition of Colenso's specimen, figs. 1–6, and further, it appears that the perithecia originate from the sclerotia, which previously bear the conidial form of reproduction.

Regarding the boxes previously mentioned it is only necessary to state that the mycelium spread through the leaf-mould, and also attacked the apple tree root and the seedling beeches.

At the close of the experiments, all the material, with the exception of microscopic preparations, was carefully destroyed by burning.

Preventive Measures.

Notwithstanding the fact that the New Zealand fungus proves to be distinct from the European root fungus, yet the general habit, mode of attack, and structure of the two are so similar, that the same methods of combatting the disease will apply to both.

Owing to the habit of the fungus in penetrating and spreading in the living tissues of the root of its victim, cure is practically outside the question when a plant is once permeated with mycelium; and keeping in view the varied modes of reproduction for facilitating the rapid spread of the disease, no efforts should be spared in the way of preventing such spreading, when the presence of the fungus is once detected.

Undoubtedly the most frequent and rapid mode of spreading is by means of the mycelium travelling in the soil, and a good method of isolating diseased patches is to cut a narrow trench, from nine inches to a foot deep round such, care being taken to throw the excavated soil into the diseased portion, and not outside it. This method, which was first suggested by Hartig, for the purpose of preventing the spread of subterranean fungi in the German forests, cannot be too strongly commended, especially where the diseased patches are small in area. The amount of success depends entirely on the thoroughness, combined with an intelligent method of carrying out the work. Half attempts invariably result in a loss of capital without benefit. It may be enough to suggest that the disease may be spread by the spores of the fungus, or infected soil being carried by the shoes of labourers, by dirty tools, wheels of carts, animals, &c. from diseased centres. Diseased and fallen trees, and especially stumps and roots, should be at once destroyed by burning. The soil surrounding diseased stumps should be burned after the stumps have been removed, so as to destroy the smaller diseased portions of the root that remained behind.

A second preventive method, which has proved of service in France, is to lay bare the trunk as far below the surface of the soil as can be done without injury to the tree, and to densely coat the exposed trunk and adjoining soil with powdered sulphur. This should be repeated when the channel round the trunk becomes filled up with earth. If, as stated by Mr. Wight, the New Zealand fungus first attacks the trunk just below the surface of the soil, this method should prove beneficial if persevered with.

Stagnant water should not be allowed to remain in the soil, as this favours the spread of the fungus.

Finally, in those cases where the fungus has completely devastated large areas, it is probable that such will be deserted as unprofitable, the trees being allowed to lie and rot, and the fungus to spread in the soil. This is disastrous, being in fact a nursery for the development and

diffusion of the enemy. It is not the object of this note to suggest whose business it is to prevent such shortsightedness, but to impress emphatically that such a condition of things should not be tolerated.

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DESCRIPTION of the FIGURES, all of which illustrate *Rosellinia radiciperda*.

Fig. 1, Ascigerous condition of the fungus, showing the perithecia natural size.

Fig. 2, perithecia enlarged.

Fig. 3, section of same, showing the wall to consist of two separate layers, enlarged.

Fig. 4, ascus containing spores, and paraphyses, × 400.

Fig. 5, tip of ascus after treatment with a solution of iodine, showing the arrangement for effecting the opening or dehiscence of the ascus for the escape of the spores, × 400.

Fig. 6, spores from an ascus, one of which is germinating, × 650.

Fig. 7, brown mycelium with swellings at intervals, × 500.

Fig. 8, a black sclerotium bursting through the cortex of a root, from which springs several slender branches bearing conidia, × 50.

Fig. 9, a single thread composing the branches, branched and bearing conidia at the tip, × 400.

Fig. 10, free conidia, × 400.

Fig. 11, a pycnidium springing from the olive mycelium, enlarged.

Fig. 12, stylospores or reproductive bodies produced in the interior of the pycnidia, × 400.

CCCCXCV.—GREAT FROST OF 1895.

The effects of a severe frost on a garden cannot be estimated immediately. Species which at first sight seem irretrievably injured recover in the most surprising manner, or at any rate send up a new growth from the roots. It is prudent therefore not to be hasty in either cutting in or removing plants which seem to have been more or less killed. On the other hand, some which at first sight seem little injured subsequently succumb. Nor is it easy to predict beforehand how any given species will stand the ordeal. In a large collection a severe winter affords many subsequent surprises. Plants which ought to be tender prove unexpectedly hardy; others which ought to be hardy turn out very much the reverse. But the results of no one winter can be taken as absolute; they are largely dependent on the amount of heat which the plants have experienced in the preceding summer. Where the wood has been well ripened they will stand an amount of cold which under other circumstances would be fatal.

At the end of the summer succeeding a severe winter it is possible to estimate the mischief which has occurred. This has now been done at Kew, and the following notes give the results. The labour of compiling a list showing the effects of the frost on individual species would have been greater than any useful result which could have been derived from it. A brief review has only therefore been attempted in general terms.

The period of severe cold began on January 26, when the minimum temperature taken in the screen fell below freezing point and never rose above it till February 22.

During this period a series of extremely low minimum temperatures on the grass was recorded. On January 23, 15°; January 29, 10°; February 7, 1°; February 8, 2°; February 9, 3°; February 12, 5°.

An extreme minimum seems usually to occur every winter between Christmas and the early part of February. The peculiarity of 1895 was its repeated occurrence during a period of nearly a month.

Before placing such remarkable temperatures on record it seemed desirable to check the performance of the instruments used by comparison with the observations taken at the Kew Observatory (Richmond), which is situated in the Old Deer Park and to the south-west of the Royal Gardens.

Mr. Chree, the superintendent, was so good as to take out the lowest temperatures observed at the Kew Observatory from 1888, and in the following table these are compared with the temperatures recorded for the same dates at the Royal Gardens. It will be seen that the two series are fairly accordant, especially for the later years.

Lowest Readings from Minimum Thermometer on Grass.

Year.	Date.	Observatory.	Royal Gardens.
		° Fahr.	° Fahr.
1888	February 2	14·1	10
1889	„ 13	8·8	2
1890	December 23	7	4
1891	January 10	9	8
1892	December 27	9	9 (Feb. 17, 6·5)
1893	January 5	7	7
1894	„ 5	11	11
1895	February 8	0	2 (Feb. 7, 1)

From the gardening point of view the effect of the prolonged low temperature would operate in two ways. Trees and woody plants generally would be liable to be killed by the freezing of their stems and branches. But these and herbaceous plants generally would have also to encounter the effects of the prolonged freezing of the ground surrounding their roots. The subsoil of Kew is for the most part a scarcely coherent sand, which retains little moisture. It was, however, frozen throughout to a depth, in one case under a gravel path, of 2 ft. 10 ins.; under grass the frost penetrated much less, probably only to an average of 20 inches. The fate of the immense and valuable collection of bulbs which had been planted out in the preceding autumn was a matter of the greatest anxiety. On the whole, though all must certainly have been frozen, the loss was less than might have been expected. The destruction of Alpine plants by cold at first sight seems paradoxical. But it must be remembered that in the Alps they are covered by a deep and warm investment of snow, which they rarely receive in England.

Besides the fate of the collections in the open air, the supply of water to those under glass, of which there are 2½ acres, was an even

greater matter of anxiety. The Royal Gardens fortunately possess their own waterworks, which are supplied directly from the Thames. The use of this water for drinking purposes is, however, prohibited by law. The drinking fountains, official residences and those belonging to the Crown, including Kew Palace, are therefore supplied by the Southwark and Vauxhall Company. On February 6 the supply from this source failed, and was not finally restored till April 30 following. For some days no drinking water was obtainable in the whole parish. It is entirely due to the indefatigable exertions made by Mr. Justin Allen, the resident assistant clerk of the works, that a similar disaster did not befall the water service of the Royal Gardens. The mains, of which there are some miles, extend to the high level reservoir in Richmond Park. By the continuous use of steam power the water in these was kept in motion, and in no single case did it freeze. By the aid of the official fire brigade the cisterns of the residences were kept filled, the consumers being warned that the water must be boiled before being used for drinking purposes.

Bulbs, &c.—The spring of 1895 will long be remembered as a particularly fatal one to many kinds of bulbs. All the narcissi of the *Tazetta* section were killed, and even some of the trumpet daffodils suffered a good deal; *maximus*, for instance, was quite killed, and this beautiful form fared no better in a large bulb-growing establishment in the neighbourhood. When taking up the ripened narcissus bulbs it was noticed that their quality was below the average; this was, doubtless, due to the fact that the roots first developed were all killed, and new ones had to be formed where the bulbs were not actually destroyed.

Hyacinths suffered badly, the white and red varieties more than the blue ones. Those in nursery beds, planted early in the previous September, were quite destroyed, whilst older bulbs planted under similar conditions six weeks or two months later survived. Hitherto winter covering for hyacinth beds had not been found to be of advantage at Kew; but in such winters as that of 1894–5 it is necessary. The wild type, *Hyacinthus orientalis*, was nearly all killed in the border.

Irids.—Many of the *Oncocyclus* group were killed, the rhizomes proving to be quite rotten when examined after the frost had gone. The "English" iris did not stand so well as the "Spanish" iris; of the former about 75 per cent. were killed. Of the English iris the survivors were so weak that they were not worth the trouble of lifting for replanting. *Iris reticulata* stood without any shelter and flowered freely; some of the bulbs dug up after they had ripened off were dried up, whilst others were perfectly sound. Many species of *Crocus* were killed outright; others were badly injured. *Crocus sativus*, for example, managed to exist on the food stored up in the corms themselves; all the roots had been killed, and in some cases the lower portion of the corms. *Gladiolus Colvillei* and its variety *alba*, planted in the open ground in January as in previous years, were killed.

Herbaceous Plants.—Lack of space renders it impossible to give a detailed statement of the losses incurred, but a few comparisons may well be mentioned. *Meconopsis wallichiana* (a fine lot of plants in pots in a cold frame) was killed under glass, whilst a couple of unprotected plants in the rockery survived and flowered. The pampas grass, *Gynerium argenteum*, was killed in the rockery, whilst on the open lawns in many places the plants, although much injured, survived and

flowered. The same remarks apply to the New Zealand *Arundo conspicua*. Even some of our native plants did not withstand the severities of the winter as well as many from countries in more southern latitudes with a warmer climate than Britain. Our native thyme, *Thymus Serpyllum*, was much cut and did not break again from the bare branches until late in the season. *Dryas octopetala* behaved in a similar way. The Cape of Good Hope *Berkheya Radula* was killed outright, whilst *B. purpurea*, under exactly similar conditions, came through the ordeal unscathed. The collection of primulas in pots in a cold frame withstood the winter successfully (better than they did that of 1893–4); there were very few deaths, and these were perhaps not due to cold. On the other hand, a considerable number of Alpine and dwarf herbaceous plants, grown in pots in cold frames for exhibition when in flower in the Alpine House, succumbed. Kniphofias, even where well sheltered with dry leaves, suffered a good deal in some spots; in others they were untouched. *Fluggea japonica*, large breadths of young plants being grown on for forming a turf in shady places where grass does not thrive, was all killed, whilst old masses which had not been transplanted were but slightly injured. Many of the cacti grown in a cold frame in the herbaceous ground were killed; amongst these may be mentioned *Opuntia brachyarthra*, *O. aurantiaca*, *O. imbricata*, *Echinocactus Wislizeni*, *Cereus cirrhiferus*, &c.

Conifers.—*Pinus insignis*, which usually suffers every winter at Kew, was scarcely affected by the frost of February. *P. tuberculata* and *P. muricata* were somewhat injured, but will soon recover. *Pinus rigida* lost most of its leaves, but has since completely renewed them. Two plants out of three, of *Podocarpus chilina*, which have stood out at Kew for the last twenty years, were quite killed; the third has grown again from the buried part of the stem. The cypresses which have quite succumbed are *C torulosa* and *C. glauca*; *C. sempervirens* and *C. macrocarpa* have been badly injured. The Golden Retinosporas have lost many small branches, whilst the ones with green, silvery, or glaucous foliage remain untouched.

Shrubs, &c.—As a rule, even shrubs generally regarded as perfectly hardy, which had been transplanted the previous autumn, were much cut up by the frost, whilst the same species which had not been removed were much less affected. Young plants of many species were killed, whereas older ones of the same species were only badly injured. Examples are *Azalea rhombica*, *Daphniphyllum*, variegated *Elæagnus*, and *Rhamnus Alaternus variegata*. In a few cases exactly the reverse has happened; as, for instance, *Berberis Darwini* and *Baccharis halimifolia*, old plants of which were killed back to hard wood and did not break again, whereas smaller ones broke freely. Double gorse and *Ulex nanus* were both killed to the ground; even in rather sheltered spots the common gorse suffered as much at Kew as it did on the commons in the neighbourhood of London. The Irish upright gorse was quite killed. Amongst other *Leguminosæ* which may be mentioned are *Cæsalpinia japonica*, young plants of which were killed, whilst older ones were uninjured. Of the yellow Spanish broom fully 90 per cent. were quite killed; young plants of *Halimodendron argenteum* died, but older ones were unaffected. The South European *Coronilla juncea* was killed even against a wall.

Peat-loving plants afford some curious results. The common Ling, *Calluna vulgaris*, and some of its varieties suffered so much that they have had to be destroyed. The only Ericas which were killed outright are *E. mediterranea*, *E. codonodes*, and some of the varieties of *E. cinerea*.

Old plants of the Cornish Heath, *E. vagans*, and of *E. cinerea* were crippled beyond recovery. *E. stricta* was damaged, but has since quite recovered. A large quantity of *Azalea indica*, raised from seed collected by Professor C. S. Sargent in Japan, stood out in the nursery, some protected, others not at all; and not one has been killed. The old single white hairy-leaved *Azalea indica* shows now no traces of the trials through which it has passed, and *A. amœna* has shaken off the effects of the frost. Judging from the behaviour of the two last-mentioned plants at Kew the former seems the hardier. *Dabeocia polifolia;* of all the stock at Kew only two plants were quite uninjured; the old plants were killed to the ground and a few young ones killed outright; but on the whole young plants have stood better than the old ones.

New Zealand shrubs have suffered much. In fact *Plagianthus Lyalli* is perhaps the only one which has entirely escaped. *P. betulinus*, in the open, was quite killed, and *P. pulchellus*, against a wall, was killed to the ground. Most of the shrubby Veronicas were badly hurt. *Rubus australis* was killed against a wall. Large beds of *Olearia Haastii* were cut down to ground, but are now breaking freely; young stuff was completely killed. *O. Traversi* and *O. macrodonta* were killed in the open; the latter even against a wall.

Choisya ternata in the open has stood well, as also against a wall, this is perhaps the only Mexican flowering shrub which can fairly be called hardy in the neighbourhood of London. Of *Ceanothus*, *C. cuneatus* is the only one at Kew which is absolutely untouched. The following species were completely killed, even against a wall: *C. papillosus*, *C. rigidus*, *C. veitchianus*, and *C. dentatus*. The garden hybrids, such as Gloire de Versailles, &c., had their points killed in the open, but they broke freely and have flowered abundantly. Some of the younger stock were also slightly cut back although they were protected by dry leaves and spruce branches. A covering of dry leaves kept from being blown away by spruce or cedar branches is the most effective winter protection for young or tender shrubs.

The only hardy *Escallonia* is *E. philippiana*, which we never attempt to sheiter at all. All the other species, in spite of protection, were badly injured; some few were killed outright, others have since freely broken from the ground level. Other South American plants which have suffered are the Azaras; the only one which has escaped in the open (where it was cut to the ground) is *A. microphylla*.

Of all the species of *Cistus* only one can be depended upon near London, viz., *C. laurifolius*, which passed through the winter unscathed, all the others being killed in the open. The shrubby Helianthemums, such as *H. alyssoides*, *H. formosum*, &c., have mostly managed to survive.

Corylopsis himalayana is alive against a wall, but has perished in the open; the other species of *Corylopsis* have not been injured in any way. One Chinese member of the witch hazel family has succumbed in the open, *Loropetalum chinensis;* this makes a pretty cool-house bush, but it is useless trying to cultivate it in the outside garden.

Of Californian shrubs all the young plants of the following have been killed in the open:—*Carpentaria californica*, *Fremontia californica*, and *Garrya elliptica*.

Of the holly family there is not much to be stated. None of the forms of *Ilex Aquifolium* seem to have suffered, but the Chinese *I. cornuta* was badly cut (it is now, however, rapidly recovering); the Himalayan *I. dipyrena* was injured in a less degree, and the South United States

I. Dahoon was quite killed. *I. crenata*, like so many Japanese plants, has again proved its hardiness.

In previous severe frosts at Kew, Laurustinus, Arbutus and the Bay, (*Laurus nobilis*) have been killed wholesale. This year they escaped, notwithstanding exposure probably to a greater degree of cold, comparatively uninjured, nor did the evergreen oaks, of which Kew possesses many exceptionally fine specimens, suffer any appreciable permanent injury.

Bamboos.—In the *Gardeners' Chronicle* (June 22, p. 762), Mr. Bean, the foreman of the Arboretum, has given an account of the behaviour of the outdoor collection of bamboos during the winter. The following extract summarizes the facts:—"On New Year's Day the Bamboo Garden at Kew looked practically in the same state as it had done in the previous August . . . . of three dozen or so kinds, ... not one has been killed outright. About half-a-dozen have scarcely been affected at all; perhaps twice as many more have suffered only a very temporary check. Of the remainder, some have been killed to the ground, whilst the others have had the old stems so severely injured that it is unlikely these particular stems will ever regain their former luxuriant leafage, although new leaves are pushing; most of them, however, are sending up strong new growths from the base, and with all, except one or two, the visible effects of the frost will have disappeared in a few months."

Our experience shows that in gardens with climatic conditions similar to those of Kew the following species may be expected to pass through even the severest winters with no more injury than a very temporary disfigurement of the foliage, and in some instances not even that. These are, consequently, the kinds which should be selected for planting in districts new to the cultivation of bamboos, and where it would be desirable to ascertain the suitability of the climate before planting extensively:—

Arundinaria nitida, Mitford (A. khasiana, *Hort*).
Phyllostachys Henonis.
„ *nigra.*
„ „ var. *Boryana.*
„ „ var. *punctata.*
„ *viridi-glaucescens.*
„ *flexuosa.*
Bambusa palmata.
„ *pygmæa.*
Arundinaria japonica.
„ *Veitchii.*

CCCCXCVI.—LEPPETT TEA.

Several articles have appeared in the *Kew Bulletin* respecting forms of tea other than those generally met with in European commerce. In the *Bulletin* for 1889, pp. 118 and 139, an account was given of P'u-êrh tea produced in the province of Yun-nan in the south-west of China. Some of the best of this is made into balls as big as a man's head for the Court of Peking. Other qualities are made into cakes well known all over the west of China. An account of compressed or tablet tea was

given in the *Kew Bulletin*, 1890, p. 109. This is manufactured at Hankow in two qualities: the inferior from common tea-dust which adheres after being steamed in a pudding-cloth and pressed by hand; the superior from the finest tea-dust which is selected with great care. The latter is manufactured into tablets by steam machinery in a steel mould. Besides these tablet teas there is a pressed tea called brick tea, used in Chinese Mongolia and Tibet. This is made of the whole leaf and the stalks, and is about the size and shape of an ordinary brick. Another and a very novel method of using tea leaves is described in the *Kew Bulletin*, 1892, p. 219. This is the Lao tea of Upper Siam, in the neighbourhood of Chiengmai. The leaves are not used for making an infusion, but are prepared wholly for the purpose of chewing. The habit of chewing "mieng," as this tea is called, is almost universal among the Laos and to men engaged in hard work, such as poling or rowing, it is said to be almost indispensable. There is yet another tea called Leppett, or Letpet tea, which is an article of local commerce in Burmah. Pony caravans carry it for sale to Mandalay and other neighbouring markets, and the Flotilla Company's steamers on the Irawady carry, sometimes, hundreds of baskets of this tea as deck cargo. In Mason's "Burmah," 1860, p. 505, there is a reference to a tea-tree from which the Burmese made a tea called "let-pet-ben." On the authority of Dr. McClelland this tree was *Elæodendron orientale*. There are references to the tea under the name of "pickled tea" in Watt's "Dictionary of the Economic Products of India," Vol. II., pp. 74–76, where it is said that it is eaten as a preserve with other articles of food; and in Vol. VI., pt. 3, p. 449, where it is stated that the European planters at Chittagong have endeavoured to prepare pickled tea for the Burma market with some degree of success. It is added: "a great future may be in store for this new industry." Samples of Leppett tea were obtained for the Kew Museums, through the Secretary of State, from the Government of India, in October 1894, and again in September 1895. There is no doubt the plant yielding it is the ordinary Assam tea-plant (*Camellia theifera*). The identification of it as *Elæodendron orientale* was from the first improbable, as the latter species is limited to Mauritius and Madagascar, and is unknown in Burma or, indeed, in any part of our Indian possessions.

The following official correspondence gives a very complete account of the Leppett tea industry:—

India Office to Royal Gardens, Kew.

India Office, Whitehall, S.W.,
30th October 1894.

Sir,

I am directed by the Secretary of State for India to forward herewith a copy of a letter from the Government of India, together with a note by Mr. W. A. Graham on "Leppett" tea the product of the plant *Elæodendron orientale*.*

The specimens of "Leppett" tea referred to in the above letter have been forwarded to your address by carrier.

I am, &c.

(Signed) C. E. Bernard,
Secretary.

The Director,
Royal Gardens, Kew.

Revenue and Statistics Department.

* See correction in Kew letter dated 25th November 1894: the plant is *Camellia theifera*.

"Leppett" Tea.

No. 49, 5 A., 10, dated Rangoon, the 4th July 1894, from C. G. Bayne, Esq., I.C.S., Revenue Secretary to the Chief Commissioner of Burma, to the Secretary to the Government of India, Department of Revenue and Agriculture.

In continuation of this office letter No. 120, 5 A. 10, dated the 7th May 1894, I am directed to submit, for transmission to Her Majesty's Secretary of State for India, seven packets containing samples of the "Leppett" tea of Burma. Four packets contain "wet Leppett" and three packets "dry Leppett." Two specimens of the plant are also submitted. A copy of a note by Mr. W. A. Graham containing information regarding the tea is enclosed.

Information regarding the "Leppett" Tea of Burma, by Mr. W. A. Graham.

1. By far the greater quantity of the tea consumed by the Burmese, called "Leppett," is grown in the Yaung Baing State of the Northern Shan States. This State is entirely given up to the cultivation of the tea tree, and the inhabitants one and all, including the Sawbwa himself, trade in the commodity.

2. The gardens are situated on the hill-sides, which, in this neighbourhood, are very steep. The trees continue to yield crops of leaves suitable for the market until they reach maturity and a height of some 60 feet, but the best article is obtained from the young shrubs, of which the gardens chiefly consist. Two crops of tea are secured each year, one in May and one in July, only the young and tender leaves being taken. The leaves, while still green, are boiled in large narrow-necked pots made for the purpose. When thoroughly boiled the contents of the pots are turned into large pits dug in the ground. These pits are square and about 6 feet deep; the sides and bottom are lined with thin walls of plantain leaves, which keep the tea pure from contact with the earth. The pit being full of boiled tea and the juices from the pots, a top made of plantain leaves is placed over it and earth is piled above it, big stones and other heavy weights being finally placed on the top.

3. The tea is thus preserved and compressed for some months, when the trading season coming on, the pits are opened and the tea is sold to the traders, who come with their caravans of bullocks and carry it away to the Mandalay market. For transport the tea is packed in long baskets, of which each bullock carries two. The baskets have no lid, but are covered in with strips of bamboo, so arranged as to serve the purpose of a lid in being air-tight, and at the same time to admit the insertion of a wedge, the pressure of which prevents fermentation from setting in. Every day the wedges are hammered in a little further, so that although the tea dries in the baskets and shrinks, a constant pressure is kept up.

4. The price of the tea at the gardens ranges from Rs. 15 to Rs. 25 per 100 viss.* When sold to the brokers in Mandalay it fetches from Rs. 60 to Rs. 100, or even to Rs. 140 per 100 viss. As the tea loses weight a good deal in transit from Yaung Baing, the traders on nearing the market usually throw the baskets for a day or two into the nearest stream, by which simple process the article is made to recover its lost dampness, and weighs as much as it did when purchased. In Upper Burma and the Shan States a good deal of this tea is consumed as a

* Viss or piakthah = 3·6 lbs. av.

drink, for which purpose it is sold in a dry state. It is prepared by boiling it in an earthen kettle, and is drunk with salt. The greater bulk, however, is sold by the Mandalay brokers to merchants in Lower Burma, where it is largely consumed in the solid. The leaves are soaked in oil, a little garlic, dried fish, &c. added, and the concoction thus formed eaten, being considered a great dainty. Besides being regarded as a dainty, however, the "Leppett" is a traditional food among Burmans. At the important junctures of a man's life, such as birth, initiation into the church, marriage, and death, "Leppett" plays an important part, and no ceremony is complete without the consumption of that article. The tea remains in the same basket from the time it is bought at the gardens until it is sold by the merchant to the actual consumer. Large numbers of baskets are to be seen at every wharf along the Irawady banks and in the bazaars throughout the country.

ROYAL GARDENS, KEW, TO INDIA OFFICE.

Royal Gardens, Kew.
November 26th, 1894.

SIR,

I HAVE the honour to acknowledge the receipt of your letter of October 30, with enclosures, relating to Leppett tea. The specimens referred to were subsequently received.

2. The information given by Mr. W. A. Graham is extremly interesting.

3. The identification of the plant producing the product with *Elæodendron orientale* appears to have been due to Dr. McClelland. It is on the face of it improbable as this species is limited to Mauritius and Madagascar and is unknown in Burma or indeed any part of our British possessions.

4. There can be little doubt from a close examination of the specimens that Leppett tea is the produce of *Camellia theifera*, the wild tea of Assam, where it was discovered in 1834. And I learn from Sir Dietrich Brandis that as a matter of fact the plant is abundant in Upper Burma and on the Upper Shan hills. The identification is historically interesting as rendering it probable that the Burmese were acquainted with the value of the indigenous plant before its discovery in Assam by Europeans. It further indicates the existence of a new area suitable for the tea industry.

I am, &c.
(Signed) W. T. THISELTON-DYER.

Sir Arthur Godley, K.C.B.,
India Office, Whitehall, S.W.

INDIA OFFICE TO ROYAL GARDENS, KEW.

India Office, Whitehall, S.W.
20th September 1895.

SIR,

IN continuation of previous correspondence, I am directed by the Secretary of State for India to forward herewith a copy of a letter received from the Government of India regarding Leppett tea (*Camellia theifera*), together with four specimens of the plant, and also a copy of a valuable report by Mr. C. W. A. Bruce on the tea industry of the

Upper Chindwin. It is suggested that extracts from Mr. Bruce's paper may be found of sufficient interest for reproduction in the *Kew Bulletin*.

I am, &c.
(Signed) HORACE WALPOLE.

The Director,
Royal Gardens, Kew.

REPORT on the TEA INDUSTRY of the Upper Chindwin, by C. W. A. BRUCE, Esq., Assistant Conservator of Forests, Upper Chindwin Division.

The following is a list of the villages of the Upper Chindwin which export tea-seeds, the inhabitants of all being Shans :—Kaungkan, Tingin, Kawya, Maungkan, Tasôn, Onbet, Mainwe, Tamanthe, Malin.

Tradition says that these "kins" (clearings) were cleared and planted some 200 years ago, the seed having been brought from Palaung (Northern Shan States). No one has ever heard of wild tea in the jungle; the gardens were originally planted for the sake of the leaves, that is, to make "letpet" the so-called pickled tea of Burma. However, some 20 years ago there arose a demand for the seed, at first intermittent, but since British occupation steady, and this has now become the main source of income to the owners, though the pickled tea is still collected and made as of old.

Method of Planting, &c.—The first thing to be done in planting a "letpet-kin" is to find the right kind of soil, what is known as "myeni," literally red earth. In this soil the tea-tree flourishes to perfection; the look of this earth is very characteristic, being a light red or buff-coloured friable loam, which occurs in patches, and wherever these patches of red earth are found on the banks of the Chindwin there villages have been built and tea planted. The jungle being cleared of all brushwood and undergrowth, three or four seeds are dibbled into holes, the holes being either two or four cubits apart. The object of dibbling in more than one seed is to guard against blanks; however, all the seeds that germinate are allowed to grow. After the plants come up all the tending the gardens receive is periodical clearing of grass, small plants, weeds, and brushwood; the ground is never hoed nor the plants pruned, except when the ravages of a parasite known as "chibaung" have become so extensive as to kill the portions above ground; the dead tops are then hacked down with the ordinary Burmese dama, the plant at once throwing up stool shoots or root-suckers which in three years take the place of the old cut down plant. The small plants become large enough to give a crop of leaves in three years if the kin is kept free of jungle, but not till five years if the garden is "dirty." Seed is borne when the plants are eight years old, but they do not come into full bearing till 15 years of age, the normal existence of a tree being 40 to 50 years, if not attacked by the parasite mentioned above. Some trees last longer than this, but old trees do not bear such good crops of seeds or leaves as middle-aged ones, being usually stagheaded, and are generally cut down, their places being taken by vigorous shoots thrown up by the stools, some stools as large as 3 feet in girth being seen. A light shade is beneficial to the plants and lessens the labour of keeping the gardens clean, as the shade kills out the rank grasses, such as thekkè, &c., which spring up if there is no shade. Heavy rains are not good for the seed-crop, as the seed drops off

without ripening; however, if the seed-crop is poor, the leaf-crop is usually good, and *vice versâ*.

Ownership.—Each house owns from one to three *kins*, the various properties being bounded by rough cactus hedges.

Crops.—As already stated, there are two kinds of crops—the leaf-crop and the seed-crop.

(*a.*) *The Leaf-crop.*—The trees flush three times a year in—(1) Tagu to Kasôn (April–May); (2) Wazo to Wagaung (July–August); and (3) Tawthalin to Thadingyut (September–October). Of these three flushes the first gives the best leaf, and brings the highest prices. The method of plucking is to pluck the whole shoot except one leaf, which is left. Thus, if there are three leaves in a shoot, the shoot is nipped off just below the second leaf. Each owner then takes his crop of leaves and throws it into an iron cauldron* full of boiling water; it is left in this water till the leaves turn a yellow colour; the water is then thrown away and the leaves rolled by hand on mats; it is then ready to be sold to traders, who take it away either packed in bamboo crates or in the internode of the *myetsangye* bamboos (*Dendrocalamus Hamiltonii*). If one wanted to keep this tea, it must either be kept buried in the ground or the crates and bamboos must be kept in water. Kawya village, which has the largest extent of "kins," makes on the average 20,000 viss of *letpet* annually. The price at the village for the produce of the first flush is usually Rs. 16 per 100 viss, for the other and later flushes Rs. 12–8 per 100 viss.

(*b.*) *Seed-crop.*—The seed-crop ripens in October and November; it is then collected, dried in the sun and sold to Burmese traders, who come up for it. The trader shoots the seed into the bottom of his boat, the bottom being roughly lined with mats, and then takes it down to Kettha or Tônhè; where he sells it to the native agents of "tea-seed chiefs."

Value.—The price of the tea-seed on the garden varies from Rs. 3 to Rs. 10 per basket, but to understand the method of buying one must bear in mind that the trader, always a Burman, comes up in January or February to bargain for the seed-crop of the following November. If possible, the trader makes a contract that the owner will sell him all the produce of the garden for a fixed sum per basket. Thus, in January 1894, the Maungkan villagers contracted to sell all their seed at Rs. 5 a basket. The trader then advances on the condition that, if the villagers cannot pay him back in tea-seed, they must pay him Rs. 100 per cent. on his money. If the trader cannot get a contract for the whole crop, he always manages to make advances for a certain proportion of the crop on the same condition. Thus, this year all the villagers of Kawya have had advances on the condition that they pay back next November (in seed), each basket to be counted as Rs. 3. Any left after the villagers have paid back, their advances usually brings double the contract price. The trader then hires boats and takes the seed to Kettha or Tônhè, the rate of boat-hire being from 2 annas to 4 annas per basket, according to distance at Kettha. He will sell to agents of the tea-planter for an average of Rs. 17 per maung (a maung = 1 basket 10 pyis, or 26 pyis). This is practically the end of the business as far as Burma is concerned, as from here it is carried by Chin or Manipuri coolies in baskets, Scotch fish-wife fashion to Manipur. No tax is collected or any transit dues exacted anywhere along the route. The Chins are said to carry a load of one basket and a quarter, the average

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* The ordinary dè of Burma, similar to the one cutch is cooked in.

weight of one basket being 14 viss, and get Rs. 5 to Rs. 6 for the journey.

Conclusion.—It will be seen that, as in most trades, the middlemen are the best off and absorb most of the profit. The Burman trader makes, even if he does not go in for the advance system, over cent. per cent., and of course his profits are doubled if he does. The Thaungdut Sawbwa has, I am told, petitioned the Government to be allowed to levy transit dues on the tea-seed passing through his State, though on what he bases his claim to the right I fail to see. No Thaungdut coolies or men in any way are interested in the trade, the development of which is solely due to the Bengalis and Burmans. The Sawbwa's clerk, Maung Kyauk Lôn, alleges that the Sawbwa used to collect six annas per basket in Burmese times; this statement is false, according to every other person I have questioned. The only transit tax the Sawbwa has ever levied was one on boats and rafts passing Thaungdut town; this has, of course, now been long discontinued. He had never anything whatever to do with the tea-seed trade. I believe Messrs. the Bombay-Burma Trading Company are experimenting as to the feasibility of sending seed to Assam viâ Calcutta; of course, if they succeed that will settle all matters of transit dues both for Thaungdut and Manipur. I see no reason why the Bombay-Burma should not succeed, as no care to prevent shaking, the effects of damp or of heat, is taken, any way prior to the seed reaching Manipur, by the present method, which seems to be as unscientific as possible, and yet the tea-seed has, as is well known, a first-class reputation in Assam for germinating properties. The tea-seed experimented with, however, I would recommend being bought at any cost in November; the best way, of course, would be to advance money on the following season's crop, this system being the custom, or else only the leavings and old seed which has been lying about can be got, which naturally would not have the same germinating power as fresh ripe seed.

From what I saw of the gardens they were wonderfully healthy considering the little care taken with them, as with the exception of the parasite referred to, the trees all seemed clean, vigorous, and full of leaf. I should say tea-planting with European methods would be a great success if only the labour question could be successfully dealt with; that once settled, all a planter who proposed planting in the Chindwin would have to do would be to prospect for red earth, and from my own experience of the forests I am sure I have come across several tracts of similar earth to that on which the tea is grown. I enclose a specimen of the tea parasite.*

CCCCXCVII.—DECADES KEWENSES

PLANTARUM NOVARUM IN HERBARIO HORTI REGII CONSERVATARUM.

DECAS XXIII.—XXV.

221. **Uvaria virens,** *N. E. Brown* [Anonaceæ]; ramulis pilis minutis fasciculatis ferrugineo-pubescentibus, foliis petiolatis oblongis obtuse acuminatis basi plus minusve rotundatis undulatis junioribus subtus

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* Not received.

parce stellato-pubescentibus demum glabris, floribus subsessilibus binis, sepalis late ovatis obtusis parce stellato-pubescentibus, petalis ellipticis vel elliptico-oblongis obtusis revolutis glabris viridibus demum luteo-viridibus, antheris apice truncatis brunneis, stigmatibus truncatis primum ochraceis vel luteo-ochraceis demum fuscis.

Habitat.—Delagoa Bay, *Mrs. Monteiro.*

Foliorum petioli 2–3 lin. longi, laminæ $2\frac{1}{4}$–$5\frac{3}{4}$ poll. longæ, 10 lin.–2 poll. latæ. *Sepala* $2\frac{1}{2}$–3 lin. longa, $2\frac{1}{2}$ lin. lata. *Petala* 5 lin. longa, $3\frac{1}{2}$–4 lin lata.

Described from a living plant raised at Kew, from seeds sent by Mrs. Monteiro, in 1886.

222. **Begonia Somervillei,** *Hemsl.* [Begoniaceæ]; caulescens, gracilis, undique glabra, ramis flexuosis, internodiis petiolos graciles paulo excedentibus, foliis, ut videtur, membranaceis vel saltem in siccis tenuissimis oblique oblongis caudato-acuminatis basi semicordatis margine remote obscureque denticulatis, inflorescentia masculina laxe cymosa axillari et pseudoterminali foliis breviore, ramulis pedicellisque gracillimis, floribus masculiuis minimis, sepalis duobus orbicularibus cucullatis, petalis nullis, staminibus numerosis omnino liberis, antheris clavatis, connectivo non producto.

Habitat.—Solomon Islands, chiefly New Georgia. *Officers of H.M.S. "Penguin,"* 1894-5.

Internodia superiora 1–$1\frac{1}{2}$ poll. longa. *Folia* cum petiolo 5–9 poll. longa. *Cymæ* $1\frac{1}{2}$–3 poll. diametro. *Pedunculi* 2–3 poll. longi. *Pedicelli* 2–3 lin. longi. *Sepala* $1\frac{1}{2}$–2 lin. diametro, stamina inclusa.

Commemorative of Boyle T. Somerville, Lieutenant, R.N., one of the collectors.

223. **Begonia Weigallii,** *Hemsl.* [Begoniaceæ]; caulescens undique glabra, ramis crassiusculis subcarnosis, internodiis quam petioli longioribus, foliis, ut videtur, membranaceis vel saltem in siccis tenuissimis oblique ovatis longe caudato-acuminatis basi semicordatis lobo petiolum æquante margine obscure denticulatis, venis primariis paucis crassiusculis, inflorescentia masculina dense cymosa, cymis subterminalibus ramulis crassiusculis, pedicellis brevissimis crassiusculis, florum masculinorum sepalis 2 orbicularibus, petalis nullis, staminibus numerosis, filamentis ima basi tantum cohærentibus, floribus femineis geminatis (an semper?) pedunculis pedicellisque brevibus crassis probabiliter carnosis, sepalis 2 late ovato-oblongis, petalis 2 oblongis, stylis 3, stigmatibus sinuoso-ramosis, fructu fere æqualiter trialato lateraliter dehiscente una facie angusta, alis membranaceis apice truncatis basi rotundatis.

Habitat —Solomon Islands, chiefly New Georgia. *Officers of H.M.S. "Penguin,"* 1894–5.

Internodia superiora $\frac{1}{2}$–2 poll. longa. *Folia* cum petiolo 3–7 poll. longa. *Inflorescentia* masculina cum pedunculo 4 poll. longa et 3 poll. lata. *Sepala* 3–4 lin. diametro. *Florum femineorum* geminatorum pedunculus 3–8 lin. longus; pedicelli circiter pollicares. *Sepala* et *petala* circiter semipollicaria. *Fructus* latior quam longus, 12–15 lin. diametro.

Commemorative of S. Weigall, Lieutenant, R.N., one of the collectors.

The fruit described above was with the flowering specimens of *B. Somervillei*, but after examining the female flowers of *B. Weigallii*, I have no doubt it belongs here.

224. **Cremaspora coffeoides**, *Hemsl.* [Rubiaceæ]; ramis floriferis elongatis gracillimis strigillosis cinereis internodiis brevibus, foliis distichis breviter petiolatis subcoriaceis anguste oblongis vel oblanceolatis acuminatis vix acutis basi rotundatis vel subcuneatis præter costam venasque primarias strigillosas cito glabrescentibus pallide viridibus, venis primariis lateralibus utrinque sæpissime 4 longe arcuatis, pedunculis brevissimis axillaribus circiter 6-floris, floribus minutis subsessilibus sericeis basi bibracteolatis, calycis lobis anguste deltoideis acutis erectis persistentibus, corollæ crassæ extus sericeæ tubo, ut videtur, brevissimo sed bene evoluto non viso, lobis ovato-oblongis obtusiusculis, bacca ovoidea primum strigillosa demum nuda.

Habitat.—British Central Africa: north side of the Ruo, *Sir H. H. Johnston*, 1895.

Folia 3–5 poll. longa, 1–1½ poll. lata, petiolis 2–3 lin. longis. *Alabastra* vix sesquilin. longa. *Baccæ* 3–4 lin. longæ.

225. **Geophila picta**, *Rolfe* [Rubiaceæ]; herbacea, caulibus subprostratis pubescentibus, foliis breviter petiolatis ovato-oblongis obtusis basi cordatis strigoso-pubescentibus venis primariis arcuatis, capitulis pedunculatis multifloris, bracteis lanceolatis acuminatis ciliatis, ovario glabro calycis lobis 5 subulato-lanceolatis æqualibus glabris, corollæ tubo subelongato fauce ampliato intus villoso, lobis patentibus lanceolato-oblongis subacutis, staminibus 5 tubo corollæ insertis, filamentis brevibus, antheris linearibus, stylo subexserto apice bidentato, stigmatibus divergentibus.

Habitat.—British Guiana: Demerara, *Im Thurn*.

Planta circa 3–4 poll. alta. *Folia* 1–2½ poll. longa, ¾–1¾ poll. lata; petioli 1½ lin. longi. *Pedunculi* ¾ poll. longi. *Capitula* ¾ poll. lata. *Bracteæ* 4 lin. longæ. *Ovarium* ½ lin. longum. *Calycis lobi* ¾ lin. longi. *Corollæ tubus* 4 lin. longus, lobi ½ lin. longi.

An interesting species which flowered in the establishment of Messrs. F. Sander & Co. in September last. The leaves are dull green on the upper surface, with a pink mid-rib and numerous pink appressed hairs all over, puberulous, and suffused with dull glaucous purple beneath. The corolla is white. It is readily distinguished by the relatively short petioles.

226. **Osmanthus Cooperi**, *Hemsl.* [Oleaceæ]; species *O. Aquifolio forma foliis integris* simillima differt imprimis foliis majoribus tenuioribus venis immersis fere obsoletis; undique glabra, ramulis floriferis gracilibus albidis crebre lenticellatis, foliis longe petiolatis coriaceis lanceolato-oblongis vel oblanceolatis subito cuspidulato-acuminatis basi cuneatis sæpius leviter inæqualibus semper integerrimis margine incrassatis costa supra impressa subtus elevata, floribus masculinis fasciculatis graciliter pedicellatis, fasciculis 3–6-floris axillaribus sæpe geminatis basi bibracteatis, bracteis brevibus latis mucronatis, calycis minuti lobis rotundatis erosis, corollæ subcarnosæ lobis oblongo-spathulatis apice rotundatis, antheris subsessilibus, ovario rudimentari parvo bifido.

Habitat.—China : probably a native of the hills near Ningpo. Specimens from a tree cultivated in the garden of H. B. M. Consulate at Ningpo, *Playfair.*

Arbor 12-pedalis, fide Playfair. *Folia* cum petiolo usque ad 5 poll. longa sed sæpius breviora; petioli 6–12 lin. longi. *Pedicelli* 3–6 lin. longi, bracteis maximis vix lin. latis. *Calyx* $\frac{1}{2}$–$\frac{1}{3}$ lin. diametro. *Corolla* 3–4 lin. diametro.

Respecting this tree, Mr. G. M. H. Playfair, H.M. Consul at Ningpo, writes :—"Mr. W. M. Cooper, formerly Consul here, informed me a short time since that he believed a certain *Olea* in the garden of the Consulate to be of an undescribed species. The tree was, I presume, transplanted by him from the neighbouring hills, like many others in the compound.

227. **Nepeta suavis,** *Stapf* [Labiatae]; perennis basi indurata canescens, caulibus tomentellis, foliis petiolatis e basi cordata ovatis obtusis obtuse crenatis utrinque tomentellis supra rugosis, verticillis in spicas inferne interruptas angustas dispositis, bracteis infimis plus minusve foliaceis cæteris albo-membranaceis viridi-venosis ovatis vel ellipticis vel oblongis villosulis calyces æquantibus, calyce villosulo leviter curvato ore oblique truncato edentulo vel dentibus obscuris obtusissimis latisque interdum uno alterove abrupte in mucronem brevem abeunte, corollæ pallide roseæ tubo curvato quam calyx subduplo longiore pubescente labio supero brevi bilobo lobo labii inferioris intermedio pupureo-punctato medio hirsuto emarginato crenulato, nuculis verruculosis.

Habitat.—Afghanistan : *Griffith,* 4060 Kew Distr.; Kuram Valley, Kaiwas and Shalizan, *Aitchison* 643.

Herba 1–2 ped. alta. *Folia* majora 7–12 lin. longa, 5–8 lin. lata; petioli ad 4 lin. longi. *Inflorescentia* ad 6 poll. longa. *Calyx* 3 lin. longus. *Corolla* 5 lin. longa.

A plant raised in the Royal Gardens from seeds communicated by Mr. J. F. Duthie in 1878, agrees with Griffith's dried specimens and Aitchison's quoted above ; but it is taller and much less hairy, and has leaves at least twice as large. The two lower calyx-teeth are nearly always produced into short mucros, whilst the middle tooth of the upper lip is generally very small and triangular, or sometimes quite suppressed. *Nepeta suavis* is nearly allied to *N. leucophylla,* Benth., from which it differs mainly in the calyx and in the broader bracts.

228. **Salvia schiedeana,** *Stapf* [Labiatæ]; caule tomentello-pubescente, foliis longiuscule petiolatis e basi rotundata vel breviter cuneata ovatis acutis crenatis utrinque minute parceque puberulis, verticillis densis in spicam subinterruptam dispositis, bracteis viridibus quam verticilli subbrevioribus vel summis multo brevioribus ovatis acuminatis ciliatis, floribus breviter pedicellatis, calyce tubuloso demum inferne subinflato superne a latere compresso clauso 3-dentato dentibus late ovatis breviter acuminatis 9-nervi in nervis prominentibus dense breviterque pilosis, corolla cyanea e calyce vix exserta tubo medio constricto et intus denticulis 2 instructo superne dilatato labio supero extus piloso erecto bilobo marginibus recurvis, labio infero trilobo porrecto lobis latis intermedio emarginato, stylo parce pilosulo labio infero breviore.

Habitat.—Mexico, *Deppe & Schiede.*

Planta 1·5 ped. alta. *Folia* majora ad 3 poll. longa, 2 poll. lata, petiolis ad 1·5 poll. longis. *Inflorescentia* ad 5 poll. longa. *Calyx* 4 lin. longus.

Specimens of this plant were raised in the Royal Gardens from seeds received from Vallombrosa under the name of *Hedeoma nepalensis*, and the description is actually drawn up from them. No indication was given as to the native country of the plant; but I have identified it with a coloured drawing in the collection of a plant "raised in 1829 from South American seeds collected by Messrs. Deppe and Schiede." *Salvia schiedeana* is nearest allied to *S. tiliæfolia*, Vahl.

229. **Polygonum (Bistorta) constans**, *Cummins* [Polygonaceæ]; gracilis, glabra, foliis cordatis ovato-lanceolatis caudato-acuminatis marginibus sinuosis inferioribus petiolatis superioribus sessilibus amplexicaulibus quam inferiores angustoribus, floribus in 1–3 racemos dispositis, racemorum pedunculis brevibus, ovario ovato, stylis 3 gracilibus basi connatis, stigmatibus capitatis.

Habitat.—Sikkim, *C. B. Clarke*, and Beroom at 12,000 ft. Thibet, *Dr. King's collector*.

Herba 6–12 poll. alta. *Stipulæ* $\frac{3}{4}$–1 poll. longæ. *Folia* 2–$2\frac{1}{2}$ poll. longa, $\frac{1}{4}$–$\frac{3}{4}$ poll. lata; petioli $\frac{3}{4}$–1 poll. longi. *Racemi* $\frac{3}{4}$–$1\frac{1}{2}$ poll. longi. *Perianthii* segmenta $\frac{1}{6}$ poll. longa. *Fructus* ignotus.

Near *P. amplexicaule*, Don., from which it differs in its thinner stem, narrower and more delicate leaves each with usually a contracted basal sinus and pointed basal lobes, also in its more slender and very shortly peduncled racemes.

230. **Arundinaria nitida**, *Mitford*, in Gard. Chron., xviii., 1895, p. 186, fig. 33 (nomen solum); ramis gracilibus paucifoliatis pallidis vel fuscescentibus, laminis patulis lineari-lanceolatis basi breviter subitoque in petiolum brevem attenuatis glabris subtus glaucis in margine asperis nervis secundariis utrinque 2–3 venulis transversis tenuibus approximatis, vaginis arctis striatis glabris in ore setis paucis instructis, ligula brevissima ciliolata, panicula parva ramis inferioribus ramulosis cæteris simplicibus omnibus glabris lævibusque in axillis glandulas foventibus, spiculis 2–4-floris glabris, gluma i. quam ii. multo breviore utraque 7-nervi inter nervos tenui, glumis florentibus lanceolatis quam gluma ii. multo longioribus dissitis apicem versus scaberulis 7-nervibus, palea bicarinata inter carinas sæpe et extra eas semper 2–1-nervi in carinis apicem versus aspera, lodiculis 3 ovatis apice fimbriatis.—*A. khasiana*, W. J. Bean in Gard. Chron., xv., 1894, p. 301, non Munro.

Habitat.—China: Hupeh, Fang District, on cliffs, 6000–9500 ft. *A. Henry*, 6832; North Szechuen, *Potanin*.

Frutex ramosissimus teste *A. Henry* in loco natali 1–2 ped. altus; cultus vero multo altior. *Folia* 2–3 poll. longa, 3–5 lin. lata. *Panicula* $1\frac{1}{2}$–3 poll. longa; ramuli infimi ad 2 poll. longi; pedicelli longitudine valde varii ad 6 lin. longi. *Spiculæ* ad 9 lin. longæ; rhachillæ articuli intermedii ad 3 lin. longi. *Glumæ* florentes 5 lin. longæ,

Nearest allied to *Arundinaria sinica*, Hance (*A. longiramea*, Munro), a native of Hong Kong, but differing in the abundant ramification, the slender, few-leaved branches, the much smaller and somewhat differently shaped leaves and the small panicle. The description was drawn up from the wild specimens quoted above.

Seeds of the plant were collected by N. Potanin in North Szechuen, China, and sent to the Botanic Garden at St. Petersburg, whence it was distributed.—*O. Stapf.*

231. **Clematis rubifolia,** *Wright* [Ranunculaceæ]; fruticosa, caule sarmentoso tenui tomentoso, foliis trifoliolatis pilis appressis vestitis, foliolis ovatis acuminatis dentatis triplicinerviis, cymis axillaribus 5–8-floris brevissime pedunculatis, sepalis oblongis acutis extus dense tomentosis, staminorum filamentis sepalis æquilongis pilis elongatis antheras tegentibus vestitis, stylo pilis rigidis albis hirsuto.

Habitat.—China: Yunnan, Mongtse, rocky places at 6000 ft., *W. Hancock*, 18.

Foliolum terminale 2½ poll. longum, 2 poll. latum; lateralia 2 poll. longa, 1½ poll. lata. *Sepala* et *stamina* 6 lin. longa.

This differs from *C. grata*, Wall. in the leaves not being lobed and the inflorescence almost sessile. *C. wightiana*, Wall. differs in having its leaves much more densely tomentose beneath.

232. **Xanthophyllum macrophyllum,** *Baker* [Polygalaceæ]; arboreum, ramulis glabris, foliis breviter petiolatis amplis oblongis cuspidatis subcoriaceis integris basi cuneatis utrinque viridibus glabris, floribus in paniculas laxas axillares quam folia breviores dispositis, pedicellis brevibus pubescentibus solitariis vel geminis, bracteis ovatis pubescentibus persistentibus, sepalis coriaceis obtusis pubescentibus exterioribus brevioribus ovatis interioribus longioribus oblongis, petalis angustis calyce duplo longioribus, carina panduriformi dorso pubescente, staminibus petalis distincte brevioribus, ovario cylindrico pubescente, stylo elongato incurvato glabro.

Habitat.—East coast of British North Borneo, *Governor Creagh.*

Folia subpedalia, media 4 poll. lata. *Sepala* exteriora 2 lin. longa; interiora 3 lin. longa. *Fructus* ignotus.

233. **Impatiens Hancockii,** *Wright* [Geraniaceæ]; herbacea, succulenta, caule erecto, foliis lanceolatis glabris bidentatis breviter pedunculatis subtus dilute viridibus, racemis ad axillas foliorum superiorum pedunculis elongatis paucifloris, pedicellis tenuibus, bracteis parvis ovatis caducis, sepalo postico magno saccato calcare elongato curvato tenui, lateralibus parvis, petalo antico cordato, lateralibus inæqualiter bilobis violaceis, capsula elongata angusta.

Habitat.—China: Yunnan, Mongtse plain 4600 ft., by a stream, *W. Hancock*, 62.

Caulis 1–1¼ ped. altus. *Folia* 3 poll. longa, 1 poll. lata; petiolus 3 lin. longus. *Pedunculus* 4 poll. longus; pedicelli 9 lin. longi. *Corolla* 6 lin. diam., 1 poll. longa; calcar 1 poll. longum.

An elegant species resembling *I. Textori*, Miq., but having a larger posticous sepal more suddenly contracted into a spur.

234. **Bauhinia (Phanera) Creaghi,** *Baker* [Leguminosæ-Cæsalpinieæ]; sarmentosa, ramulis glabris, foliis breviter petiolatis oblongis integris cuspidatis basi rotundatis subcoriaceis utrinque viridibus glabris e basi ad apicem triplinerviis, floribus in corymbos densos multifloros simplices dispositis, bracteis minutis caducis, pedicellis elongatis ascendentibus, calycis tubo cylindrico limbo 3–4-plo longiore lobis ovatis dorso pubescentibus cohærentibus vel demum liberis, petalis splendide coccineis unguiculatis dorso pilosis.

Habitat.—East coast of British North Borneo, *Governor Creagh*. Gathered also by *Burbidge* in 1877–8.

Folia 3–5 poll. longa, medio 1½–2½ poll. lata. *Pedicelli* inferiores 1½–2 poll. longi. *Calycis* tubus 6 lin. longus. *Petala* 9–12 lin. longa. *Fructus* ignotus.

A very showy species, nearly allied to *Phanera kocheana*, Korthals.

235. **Bauhinia (Phanera) brachyscypha**, *Baker* [Leguminosæ-Cæsalpinieæ]; sarmentosa, copiose cirrhifera, ramulis gracilibus pubescentibus angulatis, foliis distincte petiolatis late cordato-ovatis profunde bifidis 13–nerviis subcoriaceis utrinque viridibus glabris, floribus in corymbos multifloros terminales dispositis, pedicellis inferioribus elongatis sæpissime ascendentibus, bracteis minutis caducis, calycis tubo brevi cylindrico, lobis oblongis tubo longioribus, petalis obovatis unguiculatis sepalis 2–3-plo longioribus dorso pilosis, ovario cylindrico pubescente.

Habitat.—British North Borneo: near Tinkayo, *Governor Creagh*.

Folia 4–6 poll. longa et lata. *Pedicelli* inferiores 1½ poll. longi. *Calycis* lobi 3 lin. longi. *Petala* 7–8 lin. longa. *Fructus* ignotus.

Near *B. glabrifolia*, Baker.

236. **Bauhinia (Phanera) stenostachya**, *Baker* [Leguminosæ-Cæsalpinieæ]; sarmentosa, ramulis dense persistenter brunneo-velutinis, foliis longe petiolatis cordato-ovatis e basi 13–15-nerviis profunde bifidis subcoriaceis facie glabris dorso præsertim ad nervos persistenter brunneo-velutinis lobis apicalibus obtusis, floribus in racemos angustos elongatos dispositis, pedicellis brevibus ascendentibus atque rachi dense brunneo-velutinis, calycis tubo oblongo-cylindrico dense velutino lobis oblongo-lanceolatis tubo longioribus, petalis oblanceolato-oblongis sepalis paulo longioribus, ovario cylindrico stipitato dense persistenteque velutino, stylo brevi valido, stigmate magno peltato.

Habitat.—East coast of British North Borneo, *Governor Creagh*.

Folia 4–6 poll. longa et lata, petioli 2–3 poll. longi. *Calycis* tubus 5–6 lin. longus. *Sepala* 7–8 lin. longa. *Fructus* ignotus.

Near *B, Vahlii*, W. & A.

237. **Bauhinia (Phanera) macropoda**, *Baker* [Leguminosæ-Cæsalpinieæ]; sarmentosa, ramulis gracilibus glabris, foliis longe petiolatis late cordato-ovatis e basi 11-nerviis profunde bifidis subcoriaceis utrinque viridibus glabris lobis apicalibus acutis, floribus in corymbos terminales paucifloros longe pedunculatos dispositis, pedicellis brevibus ascendentibus, bracteis minutis caducis, calycis tubo cylindrico sulcato lobis oblongis tubo æquilongis, petalis obovatis unguiculatis sepalis 2–3-plo longioribus dorso pilosis, ovario cylindrico piloso.

Habitat.—British North Borneo: Port Myburgh, *Governor Creagh*.

Folia majora 5–6 poll longa et lata; petioli 2–3½ poll. longi. *Calycis* tubus 3 lin. longus. *Petala* 9 lin. longa. *Fructus* ignotus.

Near *B. glabrifolia*, Baker.

238. **Cæsalpinia bicolor**, *Wright* [Leguminosæ-Cæsalpinieæ]; arbor parva, ramis leviter striatis spinis paucis munitis, foliis bipinnatis, foliolis 8–12 alternis ovatis emarginatis glandulis pellucidis numerosissimis gerentibus, racemis terminalibus vel ad axillas foliorum superiorum

positis, calycis 5-partiti tubo brevi cupulari persistente lobo antico cucullato lobis omnibus deciduis, petalis (postico obcordato flavo excepto) obcuneatis rubro-purpureis calyce duplo longioribus, filamentis hirsutis petalis sesquilongioribus, antheris parvis dorsifixis, ovulis 5–7, stylo staminibus æquilongo, legumine rhomboideo lato compresso, seminibus circa 5.

Habitat.—Peru: Chachapoyas, *Lobb;* Vitor, *Maclean;* Colombia: Patia Valley, 1000–1500 ft. and Magdalena Valley near Garzon, *R. B. White*, No. 11.

Arbor 15–20 ped. alta. *Foliola* 6–9 lin. longa, 4–6 lin. lata. *Pedicelli* 5–9 lin. longi. *Petala* 6 lin. longa. *Filamenta* 9 lin. longa. *Legumen* 2 in. longum, 10 lin. latum.

239. **Homalium (Blackwellia) myrianthum**, *Baker* [Samydaceæ]; ramulis glabris, foliis subcoriaceis brevissime petiolatis oblongis obtusis integris basi cuneatis utrinque viridibus glabris, floribus in paniculas terminales et axillares ramulis multis elongatis gracillimis pubescentibus dispositis, pedicellis brevibus patulis apice articulatis, bracteis linearisubulatis, calycis tubo pubescente segmentis linearibus tubo æquilongis, petalis linearibus segmentis calycinis æquilongis, stylis 3 subulatis ovario æquilongis.

Habitat.—British North Borneo: Lilam, *Governor Creagh.*

Folia 4–5 poll. longa, 2 poll. lata. *Calycis* tubus 1 lin. longus; segmenta 1 lin. longa.

Belongs to the section *Paniculatæ* of Bentham's Monograph, and is near the Mauritian *H. paniculatum.*

240. **Arthrophyllum borneense**, *Baker* [Araliaceæ]; arboreum, glabrum, foliis inferioribus pinnatis foliolis 5 magnis oblongis integris obtusis basi inæqualibus rotundatis superioribus simplicibus, floribus ternatim umbellatis, umbellis ultimis 3–10-floris, pedicellis fructu longioribus basi articulatis, fructu globoso pericarpio membranaceo, dentibus calycinis brevissimis obtusis, stylo obconico sulcato.

Habitat.—British North Borneo: Gaya Island, *Governor Creagh.*

Arbor 16 pedalis. *Foliola* 6–7 poll. longa, 3–4 poll lata. *Pedicelli* 3–4 lin. longi. *Fructus* 2½ lin. diam.

241. **Viburnum ceanothoides**, *Wright* [Caprifoliaceæ]; fruticosum, ramis teretibus pubescentibus, foliis oppositis petiolatis obcuneatis versus apicem dentatis costa excepta glabris pseudo-flabellatim costatis, cymis multifloris terminalibus, bracteolis parvis hirsutis, floribus parvis, calyce minute 5-dentato, corolla campanulata alba lobis 5 rotundatis, staminorum filamentis prope corollæ basin affixis, antheris exsertis, ovario uniloculari, stylo brevi.

Habitat.—China: Yunnan, Mongtse, mountain ridges, 5500–6000 ft. *W. Hancock*, 47.

Folia 1½ poll. longa, 6 lin. lata. *Inflorescentia* 2 poll. diam. *Corolla* 1 lin. diam.

Readily distinguished by the form of the leaves.

242. **Uncaria grandifolia**, *Baker* [Rubiaceæ]; fruticosa, sarmentosa, ramulis teretibus ferrugineo-pubescentibus, stipulis caducis, foliis brevissime petiolatis magnis oblongis subobtusis basi rotundatis subcoriaceis facie scabris dorso dense persistenteque ferrugineo-pubescentibus,

umbellis densis globosis axillaribus pedunculatis, receptaculo globoso, pedicellis elongatis pubescentibus ovario æquilongis, ovario cylindrico ferrugineo-pubescente 10-costato e medio ad apicem et basin attenuato, calycis tubo supra ovarium brevi infundibulari segmentis ovatis intus hirsutis.

Habitat.—East coast of British North Borneo, *Governor Creagh.*

Folia subpedalia, medio 4–5 poll. lata. *Umbellæ* 5 poll. diam.; pedicelli 12–15 lin. longi. *Calycis* tubus 3 lin. longus; segmenta 2 lin. longa. *Corolla* ignota.

Near *U. sclerophylla*, Roxb.

243. **Vaccinium setosum**, *Wright* [Vacciniaceæ]; frutex humilis, cauli tereti rugoso setis brunneis vestito, foliis ovatis coriaceis marginibus recurvatis crenatis supra glabris subtus sparse brunneis pilosis, racemis multifloris prope caulis apicem confertis, bracteis rubris late lanceolatis acutis ciliatis, calycis segmentis 5 triangularibus ciliatis, corolla urceolata extus subglabra intus tomentosa segmentis 5 brevibus subulatis, staminibus 10 liberis, antheris dorso biaristatis, ovario 5–locularis, stylo staminibus æquilongo 5-alato.

Habitat.—China: Yunnan, Mongtse, on a mountain ridge at 6300 ft. *W. Hancock*, 160.

Folia 9 lin. longa, 6–7 lin. lata. *Racemi* 1½–2 poll. longi. *Corolla* 2–3 lin. longa.

Differs from *V. retusum*, Hook. f. in its acute leaves with crenate margins and from *V. griffithianum*, Wight, in its denser racemes and smaller bracts.

244. **Primula barbicalyx**, *Wright* [Primulaceæ]; humilis, foliis membranaceis ovatis dentato-sinuatis ciliatis pilosis, petiolo laminæ æquilongo dense piloso, pedunculo brevi, floribus 2–5 umbellatim dispositis, pedicellis elongatis, calyce campanulato extus (præsertim basi) pilis brunneo-purpureis vestito lobis 5 triangularibus, corolla dilute lilacina longe tubulosa segmentis 5 bilobatis.

Habitat.—China: Yunnan, Mongtse, limestone crags at 8700 ft. *W. Hancock*, 109.

Folia 1–1¼ poll. longa, ¾–1 poll. lata; *petioli* 1 poll. longi. *Pedunculi* 1 poll. longi vel breviores; *pedicelli* 6–9 lin. longi. *Calyx* 2 lin. longus. *Corollæ* tubus 5 lin. longus; limbus 6–8 lin. diam.

Resembling *P. Listeri*, King, but differing in having a smaller calyx covered with long brownish-purple hairs and a larger corolla.

245. **Buddleia acutifolia**, *Wright* [Loganiaceæ]; fruticosa, ramis teretibus primum tomentosis, foliis late lanceolatis basi apiceque acutis marginibus serratis supra pubescentibus subtus tomentosis, inflorescentia terminali multiflora paniculata, calycis cupularis extus tomentosi lobis 4 rotundatis, corolla lilacina extus tomentosa tubo elongato recto lobis 4 patulis rotundatis, staminibus 4 paullo infra corollæ faucem insertis, stylo brevi clavato.

Habitat.—China: Yunnan, Mongtse, *W. Hancock*, 143.

Folia 6 poll. longa, 2–2½ poll. lata. *Calyx* 1 lin. longus. *Corolla* 4 lin. longa; limbus 2 lin. diam.

This is near *B. variabilis*, Hemsl. but has the leaves tapering more towards the base and the lateral branches of the panicle longer. The flowers are lavender-coloured and fragrant.

246. **Fagræa spicata,** *Baker* [Loganiaceæ]; fruticosa, glabra, ramulis teretibus, foliis subsessilibus oblongis obtusis coriaceis basi breviter cordatis, floribus in spicas densas terminales breviter pedunculatas dispositis, annulo stipulari brevi truncato, rachi incrassata, calycis tubo campanulato lobis orbicularibus imbricatis tubo brevioribus, corollæ tubo infundibulari lobis parvis ovatis, genitalibus in tubo inclusis.

Habitat.—East coast of British North Borneo, *Governor Creagh.*

Folia subpedalia, 3½–4 poll. lata. *Calyx* 2½ lin. longus. *Corolla* 15–16 lin. longa. *Fructus* ignotus.

Near *F. crassipes,* Benth. and *F. morindæfolia,* Blume.

247. **Fagræa macroscypha,** *Baker* [Loganiaceæ]; arborea, glabra, ramulis validis teretibus, stipulis orbicularibus coriaceis reflexiss persistentibus, foliis distincte petiolatis coriaceis oblongis acutis basi cuneatis, floribus magnis solitariis terminalibus, bracteis magnis oblongis acutis calyce adpressis, calycis tubo oblongo lobis ovatis, corollæ tubo elongato anguste infundibulari limbi lobis ovatis patulis, genitalibus ex tubo exsertis, fructu oblongo-cylindrico calyce persistente æquilongo.

Habitat.—British North Borneo: Kinatabangan, *Governor Creagh.*

Folia 3–4 poll. longa, medio 1½–2 poll. lata. *Calyx* 2 poll. longus. *Corollæ* tubus 5 poll. longus, apice 12–15 lin. diam.; limbi lobi 1½ poll. longi.

248. **Ehretia corylifolia,** *Wright* [Boragineæ]; arborea, foliis oblongo-ovatis acutis basi rotundatis vel subcordatis dentatis utraque molliter tomentosis breviter petiolatis, cymis terminalibus multifloris, calyce profunde 5-partito extus tomentoso segmentis subulatis, corolla alba infundibuliformis segmentis 5 oblongis, staminibus exsertis antheris dorsifixis, stylo corollæ tubus æquilongo bifido.

Habitat.—China: Yunnan, Mongtse, in glens and copses, 5300 ft.; *W. Hancock,* 153.

Folia 3 poll. longa, 2 poll. lata. *Cymæ* 2 poll. diam. *Calyx* 1 lin. longus. *Corolla* 3–4 lin. longa, 5 lin. diam. *Styli* rami 1 lin. longi.

E. macrophylla, Wall. approaches this, but has scabrid leaves and a more lax inflorescence.

249. **Didymocarpus crenata,** *Baker* [Gesneraceæ]; perennis, acaulis, foliis basalibus dense rosulatis lanceolatis acutis conspicue bullatis et crenatis basi rotundatis facie parce pilosis dorso præsertim ad costam magis pilosis, petiolo brevi pilis squamosis densis vestito, scapo gracili paucifloro obscure piloso glanduloso foliis paulo longiore, floribus laxe racemosis, rachi glanduloso-pubescente, pedicellis brevibus ascendentibus, bracteis linearibus persistentibus, calycis glandulosi tubo subnullo segmentis ovatis acutis, corollæ pallide rubellæ tubo infundibulari lobis parvis rotundatis, genitalibus in tubo inclusis.

Habitat.—British North Borneo: Sandakan, *Governor Creagh.*

Folia 4–5 poll. longa, medio 9–10 lin. lata. *Calyx* 1½ lin. longus. *Corolla* 9–12 lin. longa. *Fructus* ignotus.

Near *D. bullatus,* C. B. Clarke in DC. *Monogr. Phanerog.* V. 92.

250. **Vitex holophylla,** *Baker* [Verbenaceæ]; arborea, ramulis tetragonis glabris, foliis distincte petiolatis coriaceis simplicibus oblongis acuminatis integris basi rotundatis utrinque viridibus glabris, cymis

paucifloris congestis dissitis in spicas multas paniculatas dispositis, pedicellis brevissimis velutinis interdum abortivis, bracteis lanceolatis minutis, calyce florifero tubo campanulato dentibus deltoides minutis fructifero valde accrescente ore truncato, corollæ tubo infundibulari extus velutino, fructu magno globoso duro glabro.

Habitat.—British North Borneo: Sandakan, *Governor Creagh.* Gathered previously by *Sir Hugh Low.*

Folia semipedalia et ultra, 3–4 poll. lata. *Calyx* floriferus 1 lin. longus. *Corolla* 3 lin. longa. *Fructus* 8–9 lin. diam.

Very near *V. simplicifolia*, C. B. Clarke, which is also a North Bornean plant.

CCCCXCVIII.—DATE CULTIVATION IN ANTIGUA.

The following correspondence records the promising results of an interesting experiment. There appears every reason to hope that it may in time make an important addition to the fruit resources of our West Indian Colonies.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, 18th December 1895.

I AM directed by the Secretary of State for the Colonies to transmit to you the accompanying copy of a despatch from the Governor of the Leeward Islands, forwarding a report from the curator of the Botanic Station on date cultivation at Copse Cross Station, and to request that he may be favoured with your observations thereon.

I am, &c.

The Director, (Signed) R. H. MEADE.
Royal Gardens, Kew.

(Copy.)

GOVERNOR OF THE LEEWARD ISLANDS to COLONIAL OFFICE.

Government House, Antigua,

SIR, 19th November 1895.

I HAVE the honour to transmit, for the information of the Director of the Royal Gardens, Kew, copy of an interesting report which I have received from the curator of the Botanic Station on the progress of the date cultivation at Copse Cross Station, near English Harbour.

2. Mr. Tillson concludes his report by asking for the advice of the Kew authorities as to the advisability of extending this cultivation.

I have, &c.

(Signed) GEO. MELVILLE,
Administrator.

The Right Honourable
Joseph Chamberlain, P.C.,
&c. &c.

(Enclosure.)

Botanic Station, Victoria Park,
SIR, November 12th, 1895.

I HAVE the honour to submit to you, for his Excellency the Administrator's information, the accompanying report upon the date cultivation at the Copse Cross Station.

After carefully considering the chances of success, in December 1890 I wrote the Director of the Royal Gardens, Kew, stating my views on the subject, and asked to be supplied with seed of the date of commerce.

In March 1891 I received from Kew a case of selected dates, including the famous Tafilat variety.

From the seed received I raised about 5000 plants, which were offered for sale in the Antigua *Standard*.

Date growing being a new and untried industry and long in producing a return the plants were not taken up.

Plants were put out at the various stations, others sent to the Botanic Stations of Dominica, St. Kitts-Nevis, and Montserrat, and some in exchange to Grenada Botanic Station.

It affords me much pleasure to report that at Copse Cross there are now 86 established date trees, three of which fruited during August of this year, being only 4½ years old.

The English Harbour district seems very favourable to date culture.

The following notes from "Haldane's Sub-tropical Cultivation and Climates" show the value of date cultivations, and the fine growth and early fruiting at Copse Cross are an index of what may be expected under local conditions:—"The yield of a tree in full bearing is from 100 to 200 pounds per annum, but as much as 400 pounds have been got from a single tree." "The tree generally produces eight to 10 bunches of fruit, and the produce of a hectare (2½ acres) of land under this cultivation is about 14,400 pounds of dates." The value of dates in England is, Tafilat, 70*s*. to 84*s*. per cwt.; Egyptian, 28*s*. to 45*s*.; Bussore, 13*s*. to 21*s*. The trees live to a great age and produce fruit till 200 years old."

I have the honour to request that a statement of the progress of the date plots at Copse Cross may be submitted to the Director of the Royal Gardens, Kew, and the advice of Kew obtained as to the advisability, now that we have data to go upon, of importing more seed, and endeavouring to extend date cultivation.

I have, &c.
(Signed) A. G. TILLSON,
Curator.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR, Kew, December 23rd, 1895.

I HAVE the honour to acknowledge the receipt of your letter of December 18th (22,148/95), transmitting a copy of a despatch from the Governor of the Leeward Islands, forwarding a report from the curator of the Botanic Station on the progress of date cultivation at Copse Cross Station, Antigua.

2. As far as I know this is the first instance of this palm's fruiting in the West Indies. As the trees are said not to come into *full* bearing till about 10 years, it is a culture which would probably never be taken up unless the Government set the example. It is, however, one which

is, I think, well worth encouraging on a moderate scale, as the fruit would probably meet with a ready sale in the United States market.

3. The success which Mr. Tillson has met with in obtaining fruit from seedlings only 4½ years old is interesting, as under the most favourable circumstances this rarely takes place in less than five years.

Mr. Tillson says nothing as to the quality of the fruit produced. The best kinds of date palms are not raised from seeds but are grown from "suckers."

4. The *Kew Bulletin* for the present year (pp. 161, 162) contains an account of the results of the experimental cultivation of the date palm in Australia. According to the "Annual Progress Report upon State Forest Administration in South Australia for the year 1894–95" (pp. 6, 7), a seedling date palm about eight years old yielded 50 lbs. of fruit of fair quality from eight bunches.

I am, &c.

(Signed) W. T. Thiselton-Dyer.

CCCCXCIX.—MISCELLANEOUS NOTES.

Visitors during 1895.—The number of persons who visited the Royal Gardens during the year 1895 was 1,407,369. That for 1894 was 1,377,588. The average for 1885–94 was 1,416,887.

The total number on Sundays was 536,181 and on week-days 871,188.

The maximum number of visitors on any one day was 13,583 on June 3, and the smallest 104 on November 28.

The detailed monthly returns are given below :—

January	15,026
February	12,607
March	44,612
April	139,995
May	162,784
June	297,994
July	164,672
August	288,420
September	190,318
October	49,630
November	23,402
December	17,909
	1,407,369

Botanical Magazine for December.—The plants figured are : *Streptocarpus Wendlandii*, *Aloe Luntii*, *Buddleia Colvilei*, *Bartholina pectinata*, and *Musa rubra ;* all, except the *Buddleia*, from plants cultivated at Kew. The *Streptocarpus*, a South African plant, will be remembered as one of those that flowered so freely on the edge of the central area of the cactus house. The *Aloe* is one of Mr. Lunt's

discoveries in South Arabia. *Bartholina pectinata* is a curious and elegant South African ground orchid, first introduced into cultivation at Kew by Masson upwards of a century ago, and recently by Mr. Harry Bolus, F.L.S., of Cape Town, to whom Sir Joseph Hooker has dedicated the 121st volume of the *Botanical Magazine*, which this number completes. *Musa rubra* was grown from suckers sent from Calcutta to Kew by Dr. King in 1889. It is a slender species, having rosy bracts and pale yellow flowers. The handsome *Buddleia Colvilei* flowered in the rich and interesting garden of William Gumbleton, Esq., at Belgrove, Cork.

Index Kewensis.—The completion of this important work, which is indispensable to any systematic botanist, was announced in the *Kew Bnlletin* for November last (p. 300).

It is important to point out, in order to remedy a misconception which appears to exist amcngst many persons who have used the book, that the *Index* is in no sense intended to be a standard of nomenclature, or to represent the views of Kew in the matter. It is nothing more than what it professes to be, an index of published plant names, with references to the works in which they were first promulgated and the countries of which the plants themselves are natives. Where it has been pointed out by competent authority that the names cited are "synonyms" the fact is indicated. As to the remainder no attempt whatever has been made to ascertain their validity. To have done this would have been to have undertaken a task which could not have been completed in any reasonable time, even with the aid of a large staff of skilled botanists.

The expense of preparing the work has been entirely defrayed by the members of the family of the late Charles Darwin. That of printing and publication has been borne by the Oxford Clarendon Press, which has no other means of recouping itself except by the sale of the work. For this reason Kew has not had at its disposal any copies which it could present to other institutions. The price to non-subscribers has now been raised to 10 guineas.

Palm House Terrace.—The condition of the raised flat expanse immediately surrounding the great Palm House has long been felt to be unsatisfactory and unworthy of this fine building. It had been covered with rough gravel which was unpleasant to walk upon and hot and arid to the eye in summer. A defined and kept gravel walk has now been made connecting the different steps and entrances, and the rest of the space has been laid down in turf (which it may be interesting to record has been mostly brought from Whitton Park). The surface of this is unbroken except by a few bold beds of evergreen shrubs or of herbaceous perennials.

Geranium wallichianum as a dye plant.—This is a herb with large blue flowers, native of the Temperate Himalaya at from 7,000 to 11,000 feet. A quantity of the dried roots were sent to Kew by Brigade-Surgeon

(retired) J. E. T. Aitchison, C.I.E., F.R.S., who states there they are largely used as a dye-stuff in Kashmir. They were submitted to J. J. Hummel, Esq., Professor of Dyeing in the Yorkshire College, Leeds, who has very kindly furnished the following report. The use of the plant whether for dyeing or tanning is not indicated in Watts' Dictionary of the Economic Products of India.

PROFESSOR HUMMEL to ROYAL GARDENS, KEW.

The Yorkshire College, Leeds,
December 20th, 1895.

DEAR SIR,

ENCLOSED I now send you samples of calico printed with aluminium and iron mordants and dyed with roots of *Geranium wallichianum* from Kashmir. The dark greys given by the iron mordants, and the pale soiled yellowish tints on the aluminium mordants, show that these roots contain essentially tannin matter unaccompanied by any mordant-dyeing colouring matter. The reddish stain on the unprinted, *i.e.*, unmordanted, parts of the calico indicates that there is also present some red colouring matter for which cotton has a natural attraction, but which must be regarded as of no commercial importance: indeed regarding the roots as a useful tannin matter the presence of this red colouring matter is somewhat objectionable.

In comparison with Sumach and Myrabolans, patterns dyed with which are also enclosed, it would appear that the *G. wallichianum* roots are about equal to the latter as regards amount of tannin matter present, and I have no doubt they could be usefully employed by the dyer for certain purposes either in the form of powder or as an extract, in the same manner as other tannin matters are employed.

I enclose Mr. Proctor's report which gives an analysis of the root, and some remarks as to its suitability for tanning leather, a sample of which tanned by the product accompanies his report.

Yours truly,
(Signed) J. J. HUMMEL.

W. T. Thiselton-Dyer, Esq., C.M.G., C.I.E.,
Director, Royal Gardens, Kew.

[Enclosure.]

Leather Industries Laboratory,
The Yorkshire College, Leeds.
December 14th, 1895.

DEAR PROF. HUMMEL,

The following are the results of our analysis of the root of Kao-ashud (*Geranium wallichianum*) which was sent by Dr. J. E. T. Aitchison to the Museums of Economic Botany at Kew. The sample of root contains 43·5 per cent. of matter soluble in water and, determined by the gravimetric hide powder method, gives—

Tanning matter absorbed by hide	25·7 per cent.
Soluble non-tanning matter	17·8 ,,
Vegetable fibre and insoluble	43·0 ,,
Moisture	13·5 ,,
	100·0

The colour of the extract is somewhat dark and reddish, but that of leather tanned with it is much brighter than might have been expected from the appearance of the liquor, and there certainly seems no reason

why if the material can be obtained in sufficient quantities it should not form a valuable addition to our tanning materials. The leather produced is somewhat darker but not very dissimilar to that obtained by the use of Canaigre root (*Rumex hymenosepalum*).

Apologising for long delay in reporting to you,

I am, &c.

(Signed) HENRY R. PROCTER.

Recent Presentations to the Herbarium. — Sir Ferdinand von Mueller has presented from time to time specimens of new genera and species described by himself, together with advance proofs or reprints of the descriptions. Dr. G. Haviland, who is working at Kew on his Bornean collections, has given a collection of 200 additional species. Mr. E. A. Elliott has presented a collection of dried plants made by his brother, Mr. C. F. Elliott, an officer of the Indian Forest Department, in Baluchistan and the Punjab. Sir Henry H. Johnston has presented a collection of about 150 species made by Mr. A. Whyte, F.L.S., on Mount Cheradzulu, a part of Sir John Kirk's early collecting grounds. It contained several novelties, though no new generic type. He has since sent a few additional specimens, including a curious new orchid of the genius *Holothrix*, and a new *Cremaspora*, bearing a strong resemblance to coffee. These will shortly be published in the *Bulletin*. Sir Henry Johnston has also intimated his intention of having specimens collected, as far as possible, of the trees of the district. Nothing could be more desired in this direction, because travellers are commonly unable to cope with the difficulties attending the operation. Mr. J. Burtt Davy, formerly a member of the staff, and now at the Berkeley University, California, sent about 170 specimens of Californian plants, chiefly new and critical species. From Mr. J. F. Waby, head gardener in the Georgetown Botanic Garden, British Guiana, Kew has received a collection of Barbados plants. From Mr. J. F. Duthie, Director of the Botanic Department, Northern India, there is another consignment of grasses, nearly 200 in number, in aid of the concluding volume of Sir Joseph Hooker's *Flora of British India*. A small collection of Canadian plants has been received from Mr. J. M. Macoun, Assistant Botanist to the Dominion. Finally, there is a magnificent gift of nearly 1,500 species of Central American plants, from Mr. J. Donnell-Smith, of Baltimore. This is particularly valuable, as Kew is by no means rich in the plants of this region.

Coloured figures of Fungi.—Kew has lately purchased two folio volumes of unpublished coloured drawings of fungi of great merit. There is no clue to the name of the artist, but from the fact of most of the few remarks there are on the names and localities being in the Italian language, there is little doubt that the artist was Italian. The date is less uncertain and the work was doubtless spread over a number of years. The following note accompanies a figure of a specimen of *Polyporus squamosus* eighteen inches in diameter. *Fungo nato ne i Prati de S. Pactoro il Luglio*, 1680. And a figure of *Clathrus cancellatus* bears the inscription "*Ad ripas Tiberis prope Flaminia, meuse 9bris*, 1699. Many of the figures are named in the handwriting of the late Rev.

M. J. Berkeley, and a few in that of the late C. E. Broome. Nothing more is known at Kew of its history. Altogether there are nearly 1,250 figures, most of them beautifully and accurately executed. In vigour of style they resemble Schaeffer's *Icones Fungorum*, though there is no evidence that they served as originals. Indeed that work was not published till 1762–1774.

Robert, Basse, and de Chastillon's Recueil de Plantes.—Kew has acquired by purchase a very fine copy of this magnificent collection of engravings of plants. Some copies were issued without a title-page, but Pritzel (*Thesaurus Literaturæ Botanicæ*, ed. 1. n. 8362) says "In exemplari bibliothecæ Sherardianæ Oxonii asservatæ tituli adsunt; *Estampes pour servir à l'Histoire des Plantes.* Partie i. et ii. Paris, de de l'imprimerie royale, 1701. He also gives the following title: *Recueil de Plantes dessinées et gravées par Ordre du Roi Louis XIV.*, Paris, 1701. The size he gives as 16 by 12 inches, but that is the size of the plates employed for the engravings. The Kew copy is 25½ by 19 inches. Pritzel adds: "Brunet de hac collectione monet: Recueil parfaitement éxecuté et dont on recherche encore un peu les anciennes épreuves. L'ouvrage parut d'abord sans explication; mais Monsieur Buisson a fait imprimer, vers 1780, un frontispice avec des éclaircissements sur ce recueil et une table des 319 planches; le tout formant 20 foll." The engravings are not only artistically but botanically good, and, what was rare at that date, the figures are supplemented by enlarged analyses of the flowers, and sometimes of the seed and young seedlings. The designations are the phrases, or abbreviations of them, employed by the writers of the period, such as Bauhin and Thunberg, who are cited in each case, and the arrangement is alphabetical, based on the first word.

Ipecacuanha in Southern India.—The *Kew Bulletin* for 1888 contained (pp. 123–128) an account of the various attempts which have been made to establish the cultivation of the plant producing this valuable drug in the East Indies. The annual report of Mr. M. A. Lawson, Government Botanist and Director of Government Cinchona Plantations to the Madras Government records the result recently obtained in Southern India:—

"The following interesting report has been sent by Mr. J. R. Malcolm of the Vallera Mullays:—

"In reply to yours of the 25th, I am sorry that I cannot oblige you with any ipecacuanha seed. As the plants were not getting on owing to the heavy drip from the forest trees, I took them all up and cut off the roots, obtaining 20 lb. dried only. I replanted what was left, under light artificial shade, and they seem to like it, as all are throwing shoots. The small parcel of root was sent home, and it will interest you to know that it was highly reported on. Messrs. Figgis and Co. say 'The little lot we sold for you (Messrs. Parry and Co.) was very fine picked root, nice colour, flavour, &c.' It really was not picked at all. I gathered everything I could find in the ground. It sold for 5*s.* 4*d.* per lb., the best mattogrosso fetching 5*s.* 6*d.* per lb."